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(71) Applicant
Myson Group Plc

(Incorporated in the United Kingdom)

Ongar, Essex, CM5 9RE, United Kingdom

(72) Inventors
John Ian Fraser
Richard Seremak

(74) Agent and/or Address for Service
Brewer & Son
Quality House, 5/9 Quality Court, Chancery Lane,
London, WC2A 1HT, United Kingdom

(54) A regenerative pump

(57) A regenerative pump includes a circular impeller 2 having spaced radially extending blades 4 which define channels 24 therebetween. The impeller 2 is rotatably mounted in a pump casing 8 to enable the blades 4 to pass along an annular chamber 6. A part of this chamber 6 is of reduced cross-section and forms a barrier 10. The longitudinal axis 29 of each channel 24 is inclined outwardly and rearwardly with respect to the direction of rotation of the impeller 2, and this axis may be appropriately curved.

The barrier 10 may be formed by two opposed side portions of different lengths (one may subtend an angle 30° greater than the other), and these side portions may be staggered at both the inlet and outlet of the barrier 10.

The channels 24 may be formed in opposed side walls of the impeller 2 to extend across only part of the impeller 2, and the channels on one side may be offset in relation to those on the other side (Fig 5).

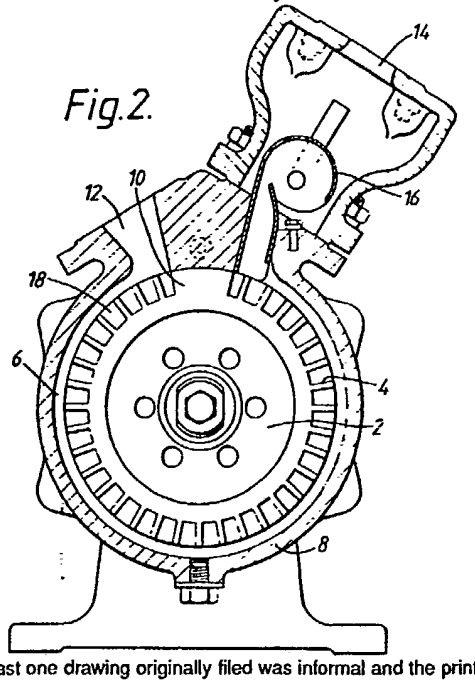

Fig.2.

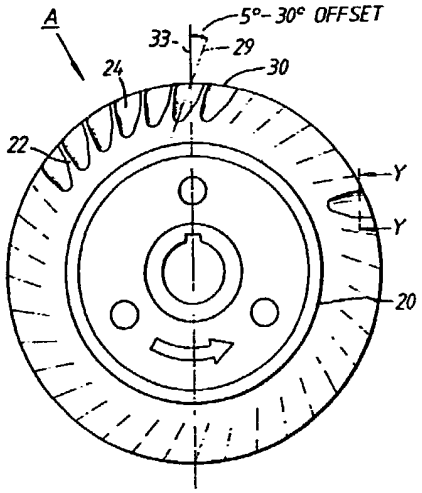

Fig.3

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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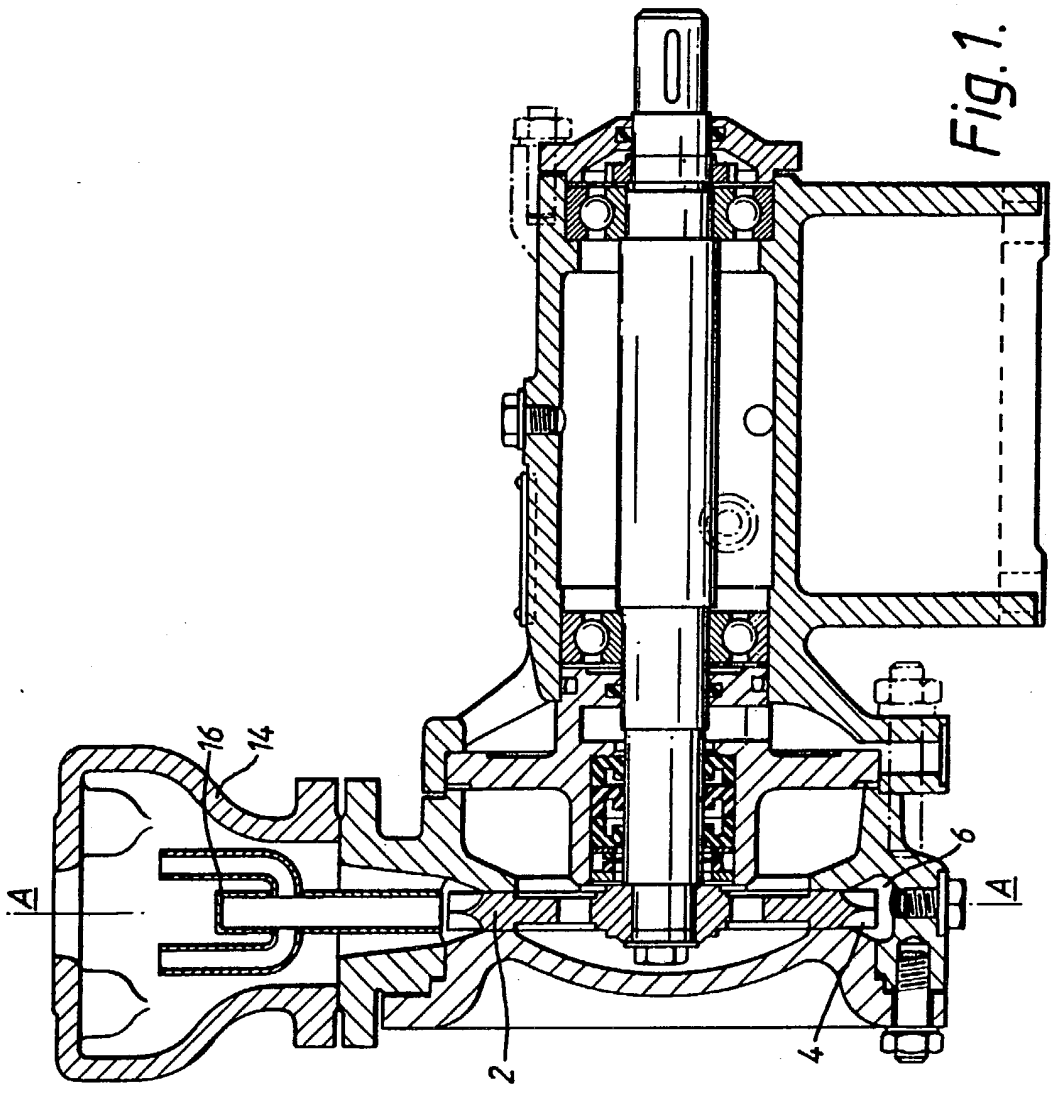

Fig.1.

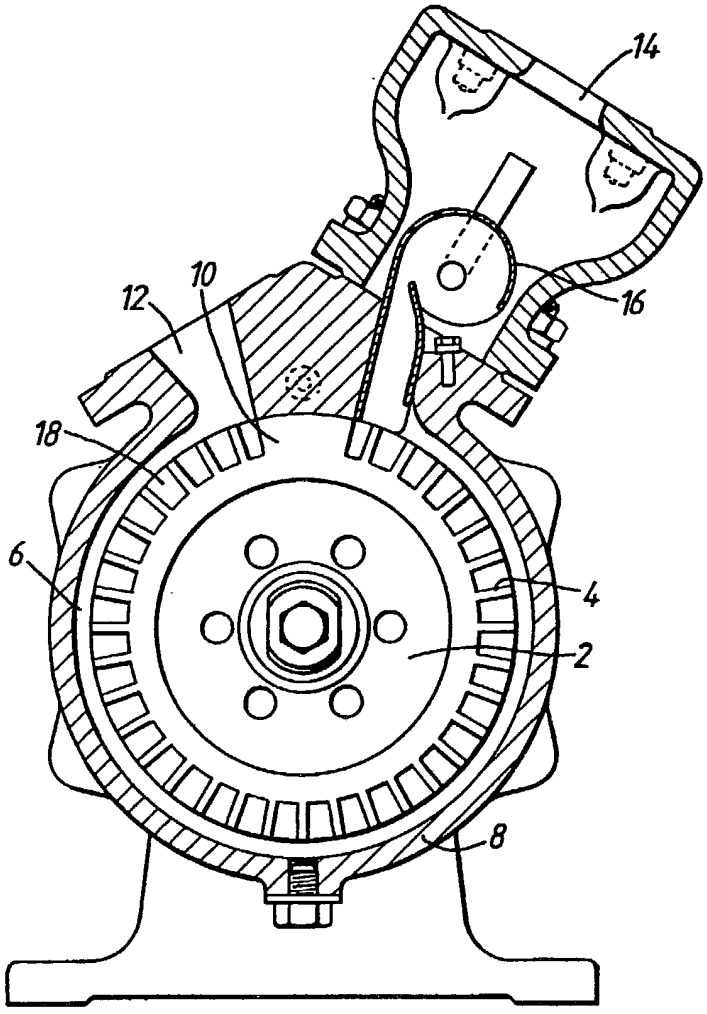

Fig.2.

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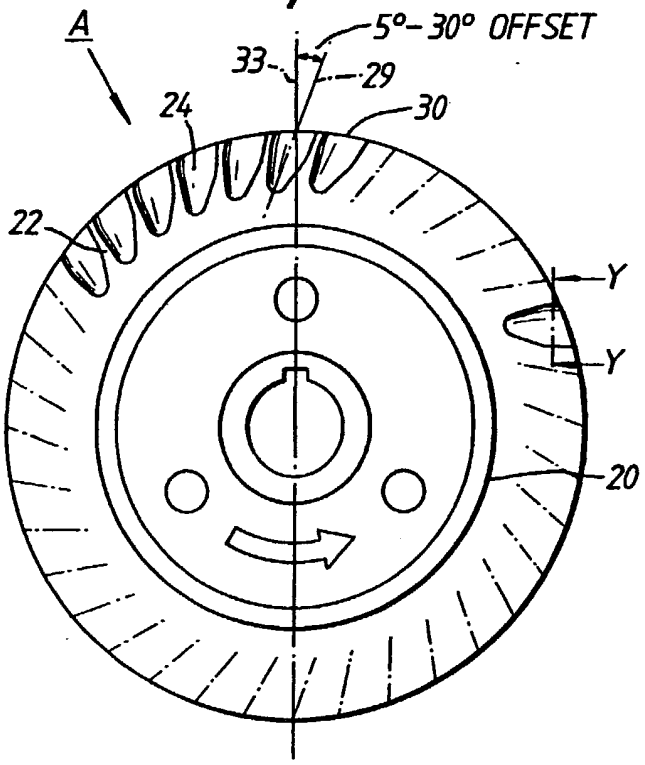

Fig.3.

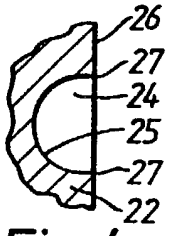

Fig.4.

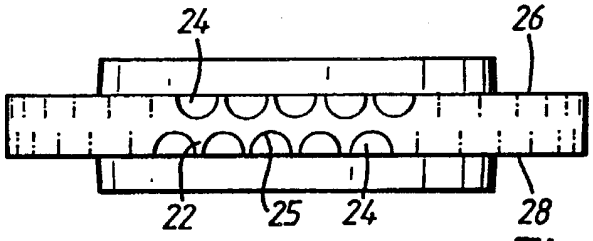

Fig.5.

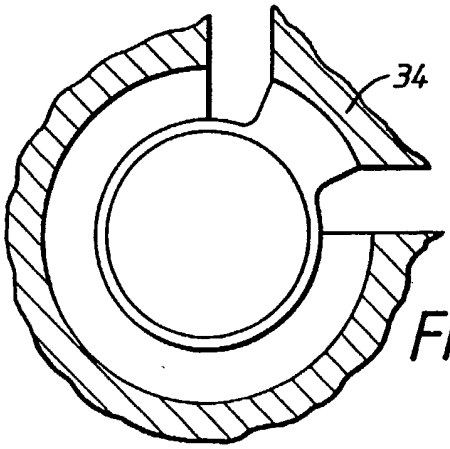

Fig.6.

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A REGENERATIVE PUMP

The present invention relates to a regenerative pump, and is particularly concerned with a regenerative pump which is suitable for use in domestic applications such as, for example, a shower pump.

In the specification by "regenerative pump" is meant a pump including a circular impeller having spaced radially extending blades located at its rim, and radially extending channels located between adjacent blades. The impeller is rotatably mounted in the pump casing to enable the blades to pass along an annular chamber. A part of this annular chamber is of reduced cross-section and forms a barrier. This reduced chamber part is generally dimensioned to provide only a very small clearance between the blades and the chamber wall. Inlet and outlet passages communicate with the chamber at opposite ends of this barrier. This pump will be referred to as a regenerative pump of the type defined.

A problem that arises with previously proposed regenerative pumps is that they have a noise level which is unacceptable or inconvenient for certain applications.

It is an aim of the present invention to alleviate this problem, and according to one aspect of the invention there is provided a regenerative pump of the type defined in which the longitudinal axis of each channel is inclined at the channel outlet to a radial line through the outlet. Preferably the longitudinal axis is inclined at an angle in the range from 5° to 30° and the said axis

extends outwardly and rearwardly with respect to the direction of rotation of the impeller.

According to another aspect of the invention there is provided a regenerative pump of the type defined in which the channels are formed in the opposed side walls of the impeller, and each channel extends across only part of the width of the impeller.

Preferably, the channels in one side wall of the impeller are offset from the channels in the opposed side wall.

According to a further aspect of the invention there is provided a regenerative pump of the type defined in which the barrier is formed by two complementary portions on opposed sides of the chamber, one of said portions being longer in the direction of the chamber than the other portion. Preferably, the said one portion subtends an angle up to 30° more than the other portion. The two portions may be arranged so that they are staggered from one another at both the inlet and outlet of the barrier.

An embodiment of the invention will now be described by way of example with reference to the accompanying illustrative drawings in which:-

Figure 1 is a side elevation in section of a previously proposed regenerative pump;

Figure 2 is a transverse section on the line A-A of the pump of Figure 1;

Figure 3 is a diagrammatic side elevation of an impeller of a pump of the invention;

Figure 4 is a section on the line Y-Y of Figure 3;

Figure 5 is a view on the line A of Figure 3; and

Figure 6 is a diagrammatic sectional side elevation on a reduced scale of part of the pump casing.

Referring to Figures 1 and 2, a previously proposed regenerative pump includes an impeller 2 having short radially extending spaced blades 4 at its rim portion. The impeller 2 rotates anti-clockwise causing the blades 4 to pass along an annular chamber 6 in the pump casing 8. During rotation of the impeller 2, the blades 4 pass through a part of the channel 6 which is defined by a barrier 10. The blades 4 and this part of the channel are dimensioned so that there is only a very small clearance between the blades and the wall of this part of the channel.

Inlet and outlet passages 12 and 14 communicate with the chamber 6 at respective ends of the barrier 10. A separator 16 is located in the outlet passage 14 to separate liquid from air, and to remove the air from the pump.

In operation, liquid passes through the inlet passage 12 and flows to both sides of the impeller blades 4 in the chamber 6. The liquid is picked up in channels 18 between adjacent blades 4, and then thrown radially outwardly in the chamber 6.

During rotation of the impeller 2 in the chamber 6 the liquid is guided back to the base of the channels 18. This operational cycle is then repeated thereby adding energy to the liquid each time it leaves and re-enters the channels 18. The greater the number of times the liquid re-enters and discharges from the channels 18 the greater the head developed by the pump. When the liquid reaches the outlet passage 14 it is then discharged from the pump.

Referring to Figures 3 to 5, an impeller 20 of the invention includes blades 22 extending radially outwardly at its rim portion. These blades 22 are defined and spaced by channels 24 which are formed in the rim portion of the impeller 20.

Referring to Figure 5, it will be seen that the channels 24 are formed in opposite side walls 26,28 of the impeller, and that each channel extends across only a part of the width of the impeller.

Referring to Figures 4 and 5, the surfaces 25 defining the blades 22 and the channels 24 are curved at their edges 27 with the side walls 26,28 so as to avoid any sharp edges or abrupt discontinuities.

Referring to Figure 3, it will be seen that the longitudinal axis 29 of each channel 24 is inclined at the channel outlet 30 to the radial line 33 through the outlet 30. This longitudinal axis 29 is inclined to the radial line 33 at an angle in the range from 5° to 30°, and the said axis extends outwardly and rearwardly with respect to the direction of rotation of the impeller. It

is to be understood that this invention includes within its scope the situation where the channel axis be appropriately curved or bent.

Referring to Figure 6, the barrier is defined by two transversely located side portions 34. One of these side portions is longer than the other side portion and subtends an angle of up to 30° greater than that of the other side portion. In a preferred arrangement, the two side portions are arranged so that both ends of the barrier are staggered. It is found that this staggering reduces both the noise level of the pump and the shock loading on the impeller blades 22.

CLAIMS

1. A regenerative pump of the type defined in which the longitudinal axis of each channel is inclined at the channel outlet to a radial line through the outlet.

2. A pump as claimed in claim 1, in which the said axis extends outwardly and rearwardly with respect to the direction of rotation of the impeller.

3. A pump as claimed in claim 1 or claim 2, in which the longitudinal axis is inclined at an angle in the range from 5° to 30°.

4. A pump as claimed in any preceding claim, in which the longitudinal axis is appropriately curved.

5. A pump as claimed in any preceding claim, in which the channels are formed in the opposed side walls of the impeller.

6. A pump as claimed in claim 5, in which each channel extends across only part of the width of the impeller.

7. A pump as claimed in claim 5 or claim 6, in which the channels in one side wall of the impeller are offset from the channels in the opposed side wall.

8. A regenerative pump of the type defined in which the barrier is formed by two complementary portions on opposed sides of the chamber, one of said portions

being longer in the direction of the chamber than the other portion.

9. A pump as claimed in claim 8, in which the said one portion subtends an angle up to 30° greater than the other portion.

10. A pump as claimed in claim 8 or claim 9, in which the two portions may be arranged so that they are staggered from one another at both the inlet and outlet of the barrier.

11. A regenerative pump of the type defined, substantially as herein described and shown in Figs. 3 to 6 with reference to Figs. 1 and 2 of the drawings.

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